III. *Observations on the Germination of Mosses: in a Letter to William Jackson Hooker, Esq. F.L.S. By Mr. James Drummond, A.L.S.*

Read March 2, 1819.

Dear Sir,

If you think the following account of some experiments made in the Cork Botanic Garden, by sowing the powder found in the ripe capsules of *Funaria hygrometrica*, and their results, would throw any light on this hitherto obscure part of the physiology of Mosses, I should feel much obliged if you would forward it to the Linnean Society.

The way in which young mosses are produced from the seeds being nearly the same in more than thirty different kinds which I have had an opportunity of observing, I select the *Funaria hygrometrica*, on account of its being one of the most common and best adapted for experiments.

In the month of May 1817 I sowed the powder found in the ripe capsules of this moss on pots of earth, previously prepared by baking in a metal oven. I plunged the pots in a basket amongst moist *Sphagnum palustre*, and the whole I kept covered with a large cap-glass, and shaded occasionally from the sun.

My object being to ascertain by different means the form of the young plants, I sowed at the same time some seeds of the moss in rain-water, in which I found them readily germinate; and by daily examining with a compound microscope the seeds sown in water, and comparing them with the young plants pro-

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duced in pots of earth, I had an opportunity of observing their true structure, which I found to agree in many particulars with Hedwig's account and figures of the same moss, as given in vol. i. part ii. of the Supplement to the *Encyclopædia Britannica*; but I was not able, by the most careful examination, to discover the roots which Hedwig figures and describes.

The seeds of mosses in germinating produce only one kind of appendages, which Hedwig describes as cotyledons; but to me they appear to differ essentially from any of the parts we are acquainted with in the seeds of phænogamous plants.

In *Funaria hygrometrica* they make their appearance on the second day after sowing, in the form of pellucid points, evidently growing out of the substance of the seed. On the fourth day each minute plant had from one to three of these appendages, each appendage growing out of a different part of the brown covering of the seed, which sometimes appeared torn, as described by Hedwig, from the bursting out of these filaments. On the seventh day they appeared, when magnified with the highest power of a compound microscope, to be about two lines in length, obtuse, jointed; and when growing in water, having some green-coloured particles appearing within them, similar to what we find deposited in the cells of the leaves in a more advanced state of the plant. But I observed that some of the articulated filaments in the pots of earth penetrated the soil in every direction and formed the roots, those filaments only being of a green colour which were growing on the surface. On the tenth day I found these filaments beginning to throw out branches. In a fortnight the surface of the pots appeared as if covered with green velvet, from the numerous branched filaments that covered every part of the soil. About the end of the third week the true leaves of the moss began to make their appearance, shooting up amongst the green articulated filaments,

and attached to them in the same way that we see the serrated leaves and capsules produced in *Phascum serratum*.

That the articulated filaments, supposed by Hedwig to be the cotyledons of mosses, are essentially different from the seed-leaves of phænogamous plants, will appear from the following experiment:—I removed a portion of the surface from the pots in which I had mosses growing from seeds, and I found (provided I did not go deeper than the conferva-like substance had penetrated) that the green part of the conferva, and ultimately the moss itself, was reproduced. And I have since found, that the small creeping roots of *Polytrichum commune* and other mosses, when the soil in which they grow is exposed to the air, throw out green articulated filaments, and produce young plants in a much shorter time than what it takes to produce them from seed. I find the time which mosses remain in the conferva state, before they produce their true leaves, to vary considerably in different species, and even in the same species under different circumstances. When regularly supplied with moisture, *Funaria hygrometrica*, *Gymnostomum pyriforme*, *Didymodon purpureum*, *Bryum hornum*, and some others produce their true leaves in about three weeks from the time of sowing; *Polytrichum undulatum* requires two months; and *Polytrichum aloides* sometimes continues four months in the conferva state; the last mentioned in that state is the well-known *Byssus velutina*, an excellent drawing of which is given in Dillwyn's *British Confervæ*, Plate 77.

The duration of the green part of the conferva-like filaments on the surface, after the mosses produce their true leaves, depends much upon the soil and situation in which they grow; in *Phascum serratum* and *Polytrichum aloides* they are almost always present; and in some mosses, supposed to be annual, I have found them remain and throw up plants in succession for several years.

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In collecting the seeds of *Funaria hygrometrica* and other mosses for sowing, I selected the most mature and perfect capsules I could get; but I did not find it necessary for the success of my experiments that the seeds should be discharged from the mouth of the capsule. And it is easy to ascertain, by sowing *Funaria hygrometrica* in water, that every grain of powder found in perfect capsules will germinate.

Cork Botanic Garden,
May 4, 1818.

I am, &c.

JAMES DRUMMOND.